

CLAIMS

What is claimed is:

- 5 1. A distance extender for increasing a distance between a first device and a second device in electrical communication with the first device, the distance extender comprising:
- an electrical cable electrically coupled between the first device and the second device and comprising:
- a first end;
- 10 a second end; and
- a plurality of wires extending between the first end and the second end;
- a first subsystem electrically coupled to the first end of the electrical cable and to the first device; and
- a second subsystem electrically coupled to the second end of the electrical cable and
- 15 to the second device,
- wherein:
- the first device or the second device generates a data signal and the first device provides an electrical power signal;
- the plurality of wires includes a first wire; and
- 20 the data signal and the electrical power signal are simultaneously transmitted between the first device and the second device over the first wire.

2. The distance extender of claim 1 wherein:

the data signal comprises at least one of mouse data and keyboard data and is transmitted from the first device to the second device and from the second device to the first device.

5 3. The distance extender of claim 1 wherein:
the first wire forms a portion of a first wire pair; and
the data signal and the electrical power signal are simultaneously transmitted between
the first device and the second device over the first wire pair.

10 4. The distance extender of claim 1 further comprising:
a switch electrically coupled between the first device and the second device.

5 5. The distance extender of claim 4 wherein:
the switch is a keyboard, video, and mouse switch.

15 6. The distance extender of claim 4 wherein:
the switch is electrically coupled between the first device and the first subsystem.

20 7. The distance extender of claim 4 wherein:
the switch is electrically coupled between second subsystem and the second device.

8. The distance extender of claim 4 further comprising:
a third subsystem substantially similar to the first subsystem; and

a fourth subsystem substantially similar to the second subsystem,

wherein:

the third subsystem is electrically coupled between the switch and the fourth subsystem;

5 the fourth subsystem is electrically coupled between the third subsystem and the second device; and

the switch is electrically coupled between the second subsystem and the third subsystem.

10 9. The distance extender of claim 1 wherein:

the electrical cable comprises four unshielded twisted wire pairs; and

the first wire is a portion of one of the four unshielded twisted wire pairs.

10. The distance extender of claim 1 wherein:

15 power to operate at least a portion of the second device is provided only by the electrical power signal.

11. The distance extender of claim 1 wherein:

the first subsystem comprises at least one of:

20 a voltage boost circuit;

a modulation/demodulation circuit;

a filter circuit;

a detection circuit; and

a pre-emphasis circuit.

12. The distance extender of claim 1 wherein:

the second subsystem comprises:

5 a voltage conversion circuit; and
 an attenuation compensation circuit.

13. A distance extender for increasing a distance between a computer and an operator control center in electrical communication with the computer, the distance extender comprising:

a Category 5-type cable comprising:

a first end;

5 a second end; and

a plurality of wires extending between the first end and the second end, the plurality of wires comprising:

a first twisted pair;

a second twisted pair;

10 a third twisted pair; and

a fourth twisted pair;

a first subsystem electrically coupled between the first end of the Category 5-type cable and the computer; and

a second subsystem electrically coupled between the second end of the Category 5-
15 type cable and the operator control center,

wherein:

the operator control center comprises:

a computer keyboard;

a computer video monitor; and

20 a computer mouse;

the computer provides an electrical power signal and the computer or the operator control center generates a data signal and a plurality of video signals;

the plurality of video signals are transmitted between the first subsystem and the second subsystem over the first, second, and third twisted pairs; and

the data signal and the electrical power signal are simultaneously transmitted between the first subsystem and the second subsystem over the fourth twisted pair.

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14. The distance extender of claim 13 wherein:

the first subsystem, the second subsystem, the computer keyboard, and the computer mouse are powered only by the electrical power signal.

10 15. The distance extender of claim 14 wherein:

the first subsystem comprises:

a voltage boost circuit;

a modulation/demodulation circuit;

a filter circuit;

15 a detection circuit; and

a pre-emphasis circuit.

16. The distance extender of claim 15 wherein:

the second subsystem comprises:

20 a voltage conversion circuit;

a modulation/demodulation circuit;

a filter circuit; and

an attenuation compensation circuit.

17. The distance extender of claim 16 wherein:

the pre-emphasis circuit increases a high-frequency portion of the plurality of video signals before the plurality of video signals are transmitted across the first, second, and third
5 twisted pairs; and

the attenuation compensation circuit compensates for a loss of amplitude in the plurality of video signals after the plurality of video signals are transmitted across the first, second, and third twisted pairs.

10 18. The distance extender of claim 15 wherein:

the first subsystem receives the electrical power signal from the computer; and

the voltage boost circuit boosts the electrical voltage signal before passing the electrical power signal to the Category 5-type cable.

15 19. The distance extender of claim 14 further comprising:

a keyboard, video, and mouse switch electrically coupled between the computer and the operator control center.

20 20. The distance extender of claim 19 wherein:

the keyboard, video, and mouse switch is electrically coupled between the first subsystem and the computer.

21. The distance extender of claim 19 wherein:

the keyboard, video, and mouse switch is electrically coupled between the second subsystem and the operator control center.

22. The distance extender of claim 19 further comprising:

- 5 a third subsystem substantially similar to the first subsystem; and
a fourth subsystem substantially similar to the second subsystem,
wherein:

the third subsystem is electrically coupled between the keyboard, video, and mouse switch and the fourth subsystem;

- 10 the fourth subsystem is electrically coupled between the third subsystem and the operator control center; and

the keyboard, video, and mouse switch is electrically coupled between the second subsystem and the third subsystem.

23. A method for increasing a distance between a computer and an operator control center in electrical communication with the computer where the electrical communication is accomplished via a cable having a first wire pair and a second wire pair, the method comprising:

providing a first subsystem to be coupled to a first end of the cable;

5 providing a second subsystem to be coupled to a second end of the cable such that an electrical power signal provided by the computer and a data signal generated by the computer or the operator control center are transmitted simultaneously across the first wire pair between the computer and the operator control center.

10 24. The method of claim 23 further comprising:

providing a switch; and

electrically coupling the switch between the computer and the operator control center.

25. The method of claim 24 further comprising:

15 electrically coupling the switch between the computer and the first subsystem; and

electrically coupling the second subsystem between the first subsystem and the operator control center.

26. The method of claim 24 further comprising:

20 electrically coupling the switch between the second subsystem and the operator control center; and

electrically coupling the first subsystem between the computer and the second subsystem.

27. The method of claim 24 further comprising:

providing a third subsystem substantially similar to the first subsystem;

providing a fourth subsystem substantially similar to the second subsystem;

5 electrically coupling the third subsystem between the switch and the fourth subsystem;

electrically coupling the fourth subsystem between the third subsystem and the operator control center; and

10 electrically coupling the switch between the second subsystem and the third subsystem.

28. The method of claim 23 further comprising:

modulating the data signal to create a modulated data signal;

modifying the electrical power signal to create a boosted electrical voltage signal;

15 coupling the modulated data signal onto the electrical power signal to create a combined signal; and

transmitting the combined signal across the first wire pair between the computer and the operator control center.

20 29. The method of claim 28 further comprising:

using the computer to generate a video signal; and

transmitting the video signal across the second wire pair between the computer and the operator control center.

30. The method of claim 29 further comprising:

demodulating the modulated data signal after transmitting the modulated data signal
across the first wire pair; and

5 reducing the boosted electrical voltage signal after transmitting the boosted electrical
voltage signal across the first wire pair.

31. The method of claim 30 further comprising:

10 compensating for attenuation of the video signal after transmitting the video signal
across the second wire pair.

32. The method of claim 30 further comprising:

15 compensating for attenuation of the video signal before transmitting the video signal
across the second wire pair.

33. The method of claim 32 further comprising:

compensating for attenuation of the video signal after transmitting the video signal
across the second wire pair.

20 34. The method of claim 31 further comprising:

filtering the combined signal to prevent the modulated data signal from interfering
with the boosted electrical voltage signal.

35. The method of claim 34 further comprising:

detecting the presence of the second subsystem at the first subsystem before enabling
the electrical power signal.

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